Exemption No. 10213

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
RENTON, WASHINGTON 98057-3356

In the matter of the petition of **Embraer** for an exemption from §§ 25.901(c) and 25.954 of Title 14, Code of Federal Regulations	**Regulatory Docket No. FAA-2011-0124**

GRANT OF EXEMPTION

By letter dated February 4, 2011, Mr. Sergio Augusto Viana de Carvalho, Airworthiness Manager, Empresa Brasileira de Aeronautica, S.A. (Embraer), Av. Brigadeiro Faria Lima, 2.1709, 12227-901 – S. J. dos Campos – SP, Brazil, petitioned the FAA for an exemption from the requirements of §§ 25.901(c) and 25.954 of Title 14, Code of Federal Regulations (14 CFR). This exemption, if granted, would permit time-limited relief from the auxiliary fuel-tanks vent system requirements for its Model EMB-135BJ airplane, modified in accordance with the Design Change Approval (DCA) 0145-000-00020-2008 (the most current FAA-approved revision; hereafter referred to as "the DCA"). The Model EMB-135BJ airplane, modified in accordance with this DCA, is commonly referred to as the Legacy 650 airplane.

The petitioner requests relief from the following regulations:

Section 25.901(c) as amended by Amendment 25-40:

(c) For each powerplant and auxiliary power unit installation, it must be established that no single failure or malfunction or probable combination of failures will jeopardize the safe operation of the airplane except that the failure of structural elements need not be considered if the probability of such failure is extremely remote.

Section 25.954 as amended by Amendment 25-14:

The fuel system must be designed and arranged to prevent the ignition of fuel vapor within the system by—

(a) Direct lightning strikes to areas having a high probability of stroke attachment;
(b) Swept lightning strokes to areas where swept strokes are highly probable; and
(c) Corona and streamering at fuel-vent outlets.

The petitioner supports its request with the following information:

This section quotes, in part, the relevant information from the petitioner's documentation. The complete documentation is available at the Department of Transportation's Federal Docket Management System, on the Internet at http://regulations.gov, in Docket No. FAA-2011-0124.

Embraer respectfully submits the enclosed petition for a time-limited exemption from the provisions of 14 CFR 25.954 and 25.901(c) as they apply for the auxiliary fuel tanks vent system of the Legacy 650 airplane, including those that incorporate flame arrestors.

Text of the Requirements for which exemption is sought

14 CFR 25.954 "Fuel system lightning protection"

"The fuel system must be designed and arranged to prevent the ignition of fuel vapor within the system by—

(a) Direct lightning strikes to areas having a high probability of stroke attachment;
(b) Swept lightning strokes to areas where swept strokes are highly probable; and
(c) Corona and streamering at fuel vent outlets."

14 CFR 25.901 "Installation"

(c) For each powerplant and auxiliary power unit installation, it must be established that no single failure or malfunction or probable combination of failures will jeopardize the safe operation of the airplane except that the failure of structural elements need not be considered if the probability of such failure is extremely remote.

Background

The Legacy 650 design retains auxiliary fuel tank vent system design concepts previously approved on other EMB 135/145 model airplanes. However, the previously accepted means of demonstrating compliance was just recently found to be deficient in some respects. As a result, it is impractical to demonstrate compliance with 14 CFR 25.954 and 25.901(c) in a timely manner for the Legacy 650. Embraer requests that this time-limited exemption be granted until unequivocal demonstration of the safety and compliance with the afore mentioned requirements is achieved through more detailed evaluation of the system and results of testing whose procedures shall be guided and approved by the FAA.

Some aspects of the proposed design and means of compliance that have been brought into question include:

- Adequacy of the means used to demonstrate the effects of lightning attachments to vent outlets.

- Potential for bypass valves to allow flames to bypass a flame arrestor, either under nominal or foreseeable failure conditions.

- Potential for hazardous ignition of fuel vapors within the tank vents used for refueling on ground, either under nominal or foreseeable failure conditions.

Embraer offers the following justification in support of this exemption, as well as, substantiation as to why the current design provides an adequate level of safety for the interim period of this exemption and why granting it is in the public interest, as required by 14 CFR 11.81.

Grounds Supporting Exemption

There are two models of flame arrestors installed in the auxiliary tanks of the Legacy 650:

- The forward and aft tanks use a circular shaped model, with no bypass valves;

- The ventral tank that is being included uses a rectangular shaped model that has two bypass valves;

Both models have the same honeycomb as the arresting element, being 2 inches long for the rectangular one and 1 inch long for the circular. The rectangular one has been certified at lightning strike zone 2A (more than 100 EMB-145XR airplanes flying with identical installation setup for accumulated 1.93 million hours) and the circular model has been certified for the baseline airplane EMB-135BJ – Legacy 600 in an identical installation at a lightning strike zone 2A (more than 150 airplanes flying for accumulated 373 thousand hours). There is no record of damage due to lightning strikes on fuel system[s] of these more than 250 airplanes that have flown more than 2.4 million hours.

These flame arrestors models have passed flame holding tests for at least 2.5 minutes (as required in the Special Condition IP P-9 – Fuel Vent System Fire Protection document, Project #TC0714AT-T – EMB-145).

Similar models have been subjected to lightning strike testing using Zone 2A threat levels as defined in the AC 20-53.

While Embraer has successfully used this method in the past, we were recently informed by the certification authorities that to find compliance with the § 25.954 requirement additional testing and/or analysis would be required.

However, currently there is no formal standard, policy or guidance from the authorities as to how this additional testing and/or analysis should be performed. Therefore time is required to reach agreement on mean of compliance and perform the additional testing and/or analysis.

Embraer intends to perform the tests by the end of October 2011 on the auxiliary tanks vent, but the actual timeframe depends upon the test guideline be[ing] provided. Regarding the test articles, Embraer intends to test the current design of vent outlets with the current flame arrestors and in what regards the bypass valves, with them open, simulating their fault.

Embraer requests a provision for up to 3 years from the date of granting this exemption should design changes be necessary. Such design changes would be incorporated into production and service instructions provided within these three years.

It is important to note that the probability of a lightning strike to attach to a vent outlet is very low, given the vents areas by total zone 2 area ratio is 2.16 x 10-5 (this can be assessed as the distribution of the lightning strikes is randomly spread, being the vent outlets not a 'preferred' attachment point as they are not protruding from the fuselage skin) and that the probability of a lightning to strike the EMB-145 aircraft (from service data) is 5.67 x 10-4 per flight which gives an overall probability of 1.22 x 10-8. This leads to, given the auxiliary tanks of the Legacy 650 have been demonstrated to have low flammability levels (around 3%), to a probability of ignition of the effluent from the vents is in the order of 10-9.

This way, the design aspects that have been found impractical to demonstrate compliance with those requirements, considering the very low probability of incidence of lightning strikes and flammability levels, provide adequate safety levels for the auxiliary tanks vent against ignition from lightning strikes, within the time period of this exemption.

Issue of Public Interest

Denial of this petition for exemption would result in the delay in certification and delivery of the Legacy 650 to the United States (U.S.). Although these airplanes are not manufactured in the U. S., a significant portion of the airplane, including the engines, avionics, interiors and the fuel system parts are supplied by U.S. manufacturers. Denial of this exemption request would result in the loss of revenue for these U.S. manufacturers and have an adverse impact on the U.S. balance of trade, both of which are counter to the public interest.

In addition, our U.S. customers have made fleet schedule plans based on the agreed-upon delivery schedule of these airplanes. To require Embraer to modify these airplanes prior to service entry will unavoidably delay delivery and have an adverse financial effect on these operators. This action would be counter to the public interest.

Request to Forego Publication in the Federal Register

Because the flame arrestor installation in the Legacy 650 is identical to those found in other airplanes in service, the granting of this exemption to 14 CFR § 25.954 and § 25.901(c) would create no precedent compared to previous models, both from Embraer and other manufacturers, that have been certified without exemptions. In addition, this petition requests only 12 months to complete the tests and assessments for the identified aspects. Accordingly, Embraer requests that the FAA does not delay granting of this exemption for publication of the petition summary in the Federal Register as allowed by 14 CFR §11.87.

Embraer has a contract with a U.S. operator to deliver the first Legacy 650 by the end of December 2010 that has already been delayed to middle February due to the certification process. As above mentioned, more delays in the delivery will adversely affect this operator forcing him to seek alternatives to his planned use of the airplane, such as canceling scheduled flights, chartering alternative lift, etc. or even canceling the contract.

Embraer also notes that this petition was filed immediately after identifying the impracticability of FAA in finding the compliance.

In summary, there exists the necessary justification for forgoing publication of a petition summary in the Federal Register, and Embraer respectfully requests that [the FAA] grant this petition without delay.

Effect of the Exemption on Safety

The entire EMB-145XR and Legacy 600 fleet (more than 250 airplanes worldwide) have the same auxiliary tank fuel vents as the Legacy 650. There are more than 140 of such airplanes currently operating safely within the U.S. territory for over 8 (eight) years and are expected to continue to do so for many years to come. Eight airplanes are expected to be delivered within the first 12 months. If compliance is found there would have been no effect on safety. If modifications are required at most a total of 25 aircraft would have been added to the current fleet within the three years of this exemption. Therefore, granting this exemption will not significantly affect the overall safety of the U.S. fleet, as the contributions of the accumulated hours of the 25 more airplanes (that have low utilization typical of such business jets) with a similar level of risk to that fleet, clearly represent a negligible impact on the total fleet safety.

Operations Outside the United States

As a manufacturer and not an operator, Embraer does not intend to operate outside the United States under the terms of the exemption which we are requesting, but some of our operators will certainly fly the Legacy 650 internationally. The granting of this petition will not conflict with any of the terms of ICAO Annex 8, so the FAA will not need to file a difference with ICAO, as described in 51 1.83.

***Federal Register* Publication**

The FAA has determined that good cause exists for waiving the requirement for *Federal Register* publication because the exemption, if granted, would not set a precedent, and any delay in acting on this petition would be detrimental to Embraer.

The FAA's analysis

Introduction

To obtain this exemption, the petitioner must show, as required by § 11.81(d), that granting the request is in the public interest, and, as required by § 11.81(e), that the exemption will not adversely affect safety, or that a level of safety will be provided that is equal to that provided by the rules from which the exemption is sought.

The FAA recommendation to locate fuel-vent outlets within lightning-strike Zone 3 (e.g., DOT/FAA/CT-89/22, "Aircraft Lightning Protection Handbook"), and the common practice of doing so, has led to the FAA not yet having to establish any standard, acceptable means of demonstrating compliance for fuel-vent outlets located in Zone 2A. As the petitioner notes, the compliance means they used previously have been found deficient. This exemption is intended to allow the petitioner time to either propose a means of compliance acceptable to the certification authorities, or re-design the system to comply.

Public Interest

The FAA agrees with the petitioner that the adverse impacts on U.S. interests, including upon component manufacturers and operators, of delaying approval of this type design amendment for approximately one year is not warranted as this granting would not materially impact the level of safety currently provided by the certificated baseline type design from which this amended type design was derived.

Effect on Safety

The petitioner estimates that, at most, eight airplanes of the noncompliant type design will be delivered to U.S. operators, and these will be operated for, at most, one year before it can be

determined whether or not that type design complies with the subject regulations. If it does comply, then the granting of this petition would have had no adverse effect on safety. If we find that the subject type design does not comply, then a maximum of 25 airplanes of the noncompliant type-design airplanes are expected to be delivered to U.S. operators, and these will be operated for a maximum three years before a compliant type design would be put into production, and service instructions made available for retrofit.

As the petitioner points out, the risk associated with any noncompliance that is foreseen to be associated with this granting is limited by the probability of a lightning attachment near one of the subject vent outlets while the fuel vapor within that vent is flammable. While the petitioner's assessment of that probability appears to have failed to take into account certain relevant influences, such as the fact that several lightning attachments can occur within this swept stroke zone during each lightning strike event, the FAA agrees that having a lightning strike attach near any flammable auxiliary fuel-tank vent outlet, subject to this exemption, is extremely remote (i.e. has a predicted frequency of occurrence less than once every ten million flight hours).

Given the relatively low expected utilization of this type of business jet, even if we assumed all the flame arrestors are completely ineffective and the refuel vent valves are unreliable, the risk that is expected to accumulate within this 25 airplane fleet over the proposed three-year period is still very low. If, as we expect, some of the flame arrestors are found to be effective protection for at least some of the events, and the refuel valves are reliable, then the predicted risk becomes even lower. We will have a more accurate assessment of these risks, including how effective each arrestor is, within the first year of this exemption, and should any subsequent alternate or additional actions be deemed warranted to protect any part of the affected fleet, that action will be taken either under Part 39 or by amending this exemption as appropriate.

The FAA's Decision

In consideration of the foregoing, I find that a grant of exemption is in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. §§ 40113 and 44701, delegated to me by the Administrator, Embraer is hereby granted an exemption from the requirements of 14 CFR 25.954 and 25.901(c) as they relate to the Model EMB-135BJ (Legacy 650) airplane auxiliary fuel-tank vent systems, with the following conditions and limitations:

1. On or before six months from the date of granting this exemption, Embraer must have obtained FAA approval of a plan for meeting limitation 2.a (below).

2. Embraer must have demonstrated that the auxiliary fuel-tank vent systems fully comply with the provisions of § 25.901(c) at Amendment 25-40 or later; and § 25.954 at Amendment 25-40 or later:

    a. On or before one year from the date of granting this exemption for the Model EMB-135BJ (Legacy 650) airplane, as modified by DCA 0145-000-00020-2008 (most current FAA-approved revision), which is the subject of this exemption; or

b. On or before three years from the date of granting for a new proposed amendment to the Model EMB-135BJ (Legacy 650) airplane type design.

3. Embraer will develop and submit, for FAA approval, any service information required to incorporate any design changes and/or operating and maintenance limitations developed to meet:

   a. Limitation 2.a (above) within one year of granting this exemption.

   b. Limitation 2.b (above) within three years of granting this exemption.

4. Airplanes for which application for airworthiness certificate is made:

   a. After one year from the date of this granting must incorporate any design changes and/or operating and maintenance limitations developed to meet limitation 2.a (above).

   b. After three years from the date of this granting must incorporate any design changes and/or operating and maintenance limitations developed to meet limitation 2.b (above).

5. The FAA will not issue original airworthiness approvals for Model EMB-135BJ (Legacy 650) airplanes after three years from the date of granting this exemption unless Embraer has shown full compliance with the provisions of this exemption by that date.

Issued in Renton, Washington, on FEB 17 2011

Ali Bahrami
Manager, Transport Airplane Directorate
Aircraft Certification Service